Simulation Update

William Shields

(william.shields@rhul.ac.uk)

WP6 Meeting

06th June 2023

Target Housing Emittance Check

Distance from Target	Step	Emittance (x 10^{-8})		
		rebdsimOptics	GPT - Tout	GPT - Screen
0cm	Initial Conversion	8.376	8.509	8.508
5cm	GPT transport (no SC)	8.381	8.509	13.252
5cm	2mm radial cut	7.021	7.129	10.168
10cm	GPT transport (with SC)	12.517	12.703	20.882
10cm	2.87mm radial cut	7.981	**8.101**	13.116
10cm	Down-sampling (factor 10)	8.129	**8.251**	12.927

- GPT screen different to GPT tout beyond initial beam
  - No change in emittance expected between 0 & 5cm (no SC), yet is observed

- GPT emittance values are from **gdfa** (GPT analysis program)
  - rebdsimOptics emittances are independent calculations using GPT tout data

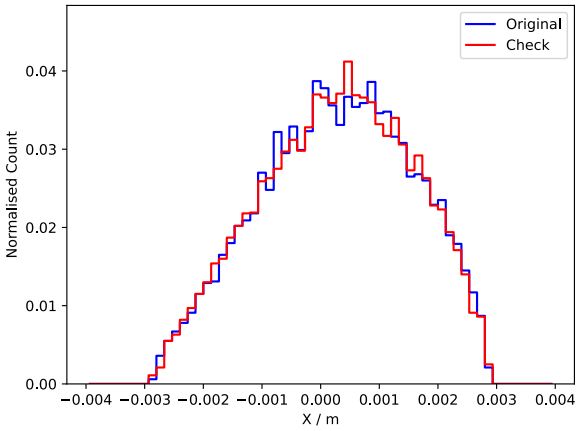
Target Housing Emittance Check

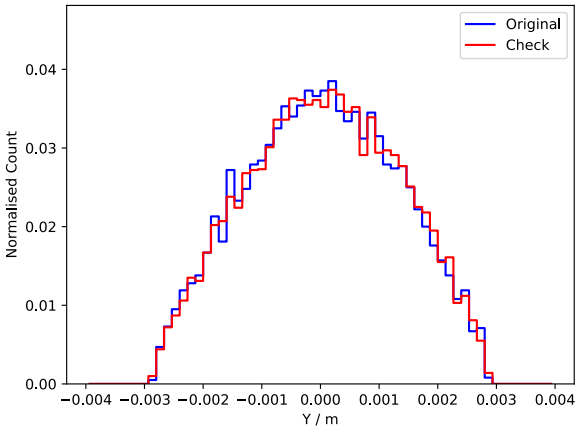
	Smilei Sampled Beam	**SCAPA Beam Original**	**SCAPA Beam Check**	Pre-CDR Beam
Mean RMS emittance [m]	1.43×10^{-8}	**7.98×10^{-8}**	**8.10×10^{-8}**	3.26×10^{-7}
Mean beta [m]	141.34	**21.62**	**20.22**	4.89
Mean alpha	-1418.43	**-222.23**	**-204.98**	-50.22

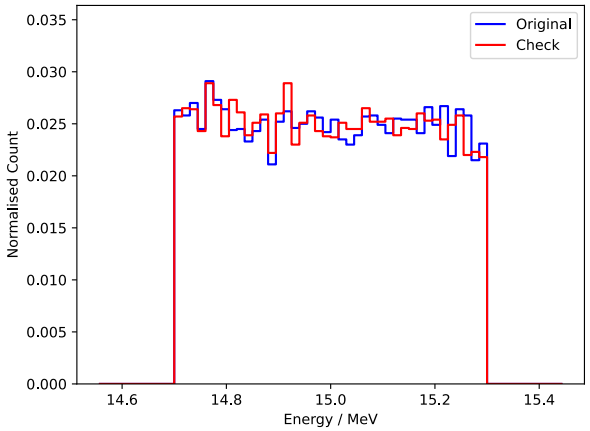
- Small (<10%) difference between SCAPA beam simulations
  - Random number generator when down-sampling

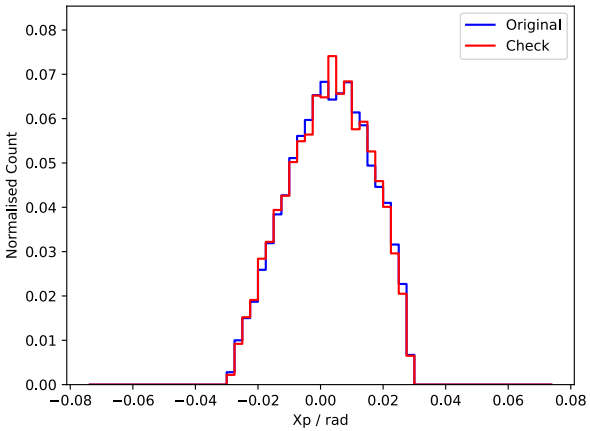
- Larger uncertainty from overall methodology – co-propagating beams

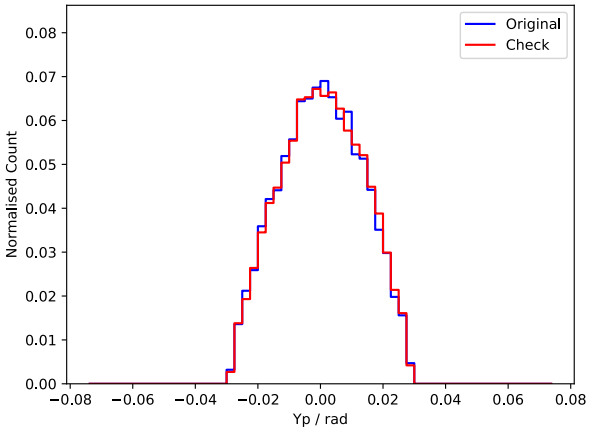
Beam Profile Comparison

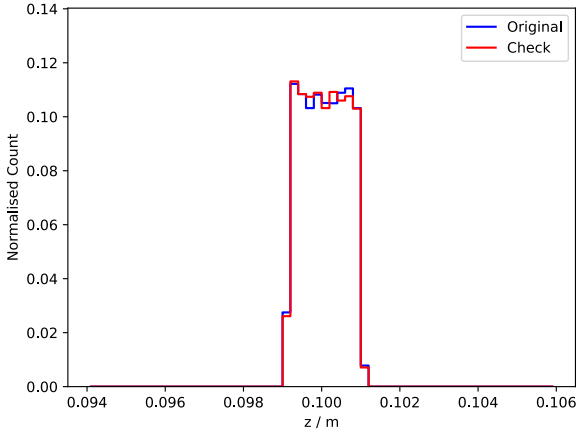












Summary

- Done:
  - Recheck target housing beam transport & emittance calculations

- Ongoing:
  - Re-running of stage 1 beam transport simulations – understand emittance changes
    - Beta = 50 m – GPT constrains beam size
    - Spot size = 8.05mm if emittance unchanged
  - Re-run optimisation routines

- Todo:
  - Comparison to baseline design
  - Write talk for IOP PAB
  - Update models of alternative baseline design (v5.5)
  - Develop OPAL model of FFA – need JP input.